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NO. 4395
PRECISION VOLTAGE DIVIDER

LEEDS NORTHRUP
PHILADELPHIA 44, PA.

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PRECISION VOLTAGE DIVIDER

1. GENERAL DESCRIPTION

The No. 4395 Precision Voltage Divider provides a precise means of dividing a known d-c voltage into parts. The known voltage is applied to the input terminals and the three ratio dials and the slidewire are adjusted to obtain desired fractions of the input voltage at the output terminals. When the voltage divider is properly connected in the circuit under test, the output voltage is used for null balance measurements or checks.

Three keys are provided in the output circuit of the instrument and are so arranged as to allow a choice of three sensitivities of null detection. It is recommended that the Leeds & Northrup Co. No. 2310-D or No. 2420-C Galvanometer be used as a null detector with this voltage divider. The No. 2310-D galvanometer will provide adequate sensitivity for most measurements while the No. 2420-C Galvanometer permits more precise determinations.

When properly connected in a bridge circuit the voltage divider is particularly useful in checking or calibrating linear and non-linear potentiometers (see Section 3B).

The voltage divider has a constant input resistance of 100,000 ohms. Its output voltage is adjustable to within one part in 100,000 of the input voltage which may be of any magnitude between 0 and 200 volts d-c.

2. WIRING CONNECTIONS

The internal wiring connections of the voltage divider are shown in Fig. 1. It will be noted that one of the input terminals and one of the output terminals are connected together internally and are marked GR. on the voltage divider panel, Fig. 2. If the input voltage is grounded, the grounded side should be connected to the input GR. terminal.

NOTE: The maximum input voltage which may be connected to this instrument is 200 volts d-c (continuous rating).

It is to be noted that the three SENSITIVITY keys are connected in the circuit from the slidewire contact to the ungrounded OUT terminal. When making null measurements, the galvanometer is connected between this terminal and the voltage being measured. Thus, 10000 ohms, 10000 + 22000 ohms, or 10000 + 22000 + 470000 ohms (see Fig. 1) is connected in series with the galvanometer according as key 3, 2, or 1 is depressed. Therefore, key 1 should be depressed for lowest sensitivity, key 2 for next higher, and key 3 for highest sensitivity. When obtaining a null, the

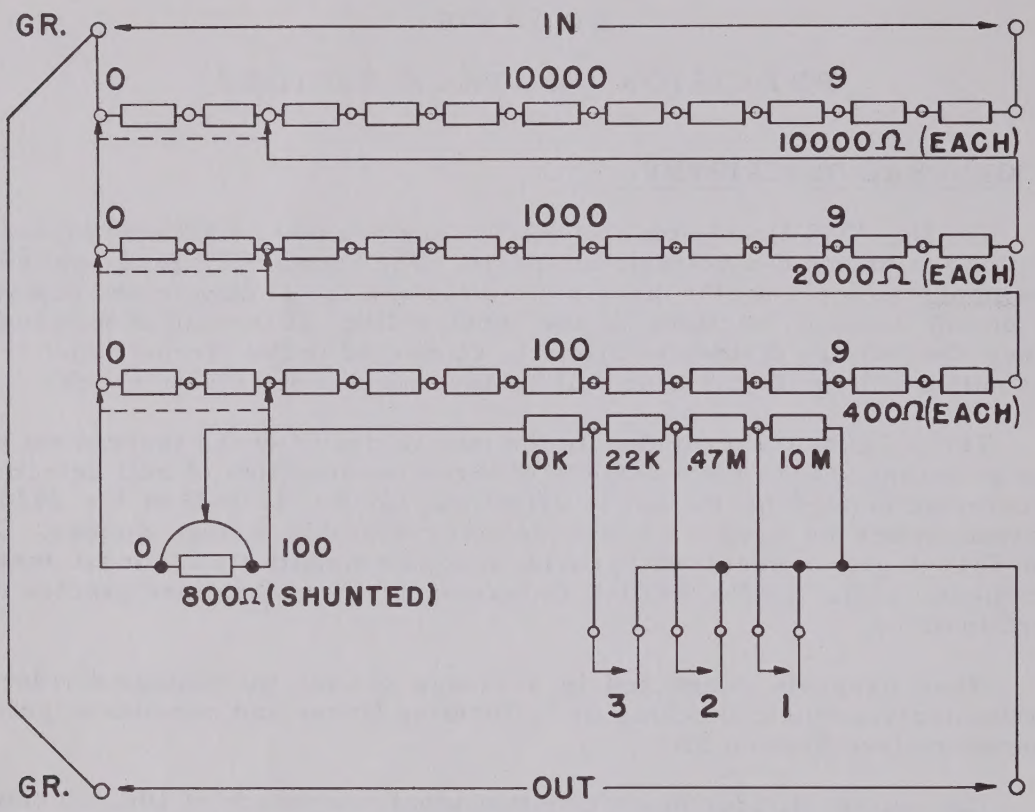

Fig. 1 - Internal Circuit

keys should be depressed successively in this order.

3. TYPICAL APPLICATIONS

A. To Measure Or Check Voltage

Connect the known input voltage, the galvanometer, and the unknown voltage source to the voltage divider as in Fig. 3. Adjust the three dials and the slidewire, which is operated by knob S, Fig. 2, to obtain no deflection of the galvanometer when the SENSITIVITY keys are depressed. When this null is obtained, the output voltage of the voltage divider is equal to the unknown voltage. The value of the output voltage is calculated as follows:

$$E_{out} = \frac{E_{in} R_T}{100{,}000}$$

where E_{in} = input voltage in volts
E_{out} = output voltage in volts
R_T = instrument reading

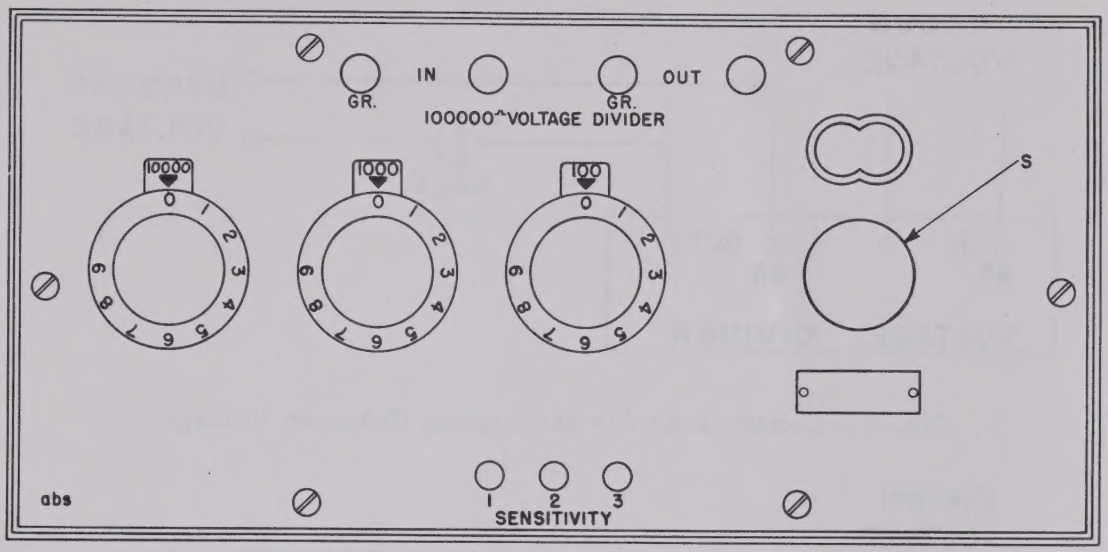

Fig. 2 - Instrument Panel

The instrument reading is obtained by adding the readings of the three dials and the slidewire. A dial reading is obtained by multiplying the dial setting by the multiplier engraved on the dial index; the slidewire scale is direct reading.

EXAMPLES

Assumptions:

Dial readings: 2 x 10000, 5 x 1000, 1 x 100

Slidewire reading = 32

E_{in} = 10 volts

Calculations

$$R_T = 20000 + 5000 + 100 + 32 = 25132$$

$$E_{out} = \frac{E_{in} R_T}{100{,}000} = \frac{10 \times 25132}{100{,}000} = 2.5132 \text{ volts}$$

B. Calibration Of Slidewire

Connect the uncalibrated slidewire, a detector, the voltage divider, and a constant voltage source as shown in Fig. 4.

Division of the slidewire for any slidewire voltage may be made using any input voltage by setting the voltage divider and moving the slidewire contact to secure a null balance in accordance with the following relation:

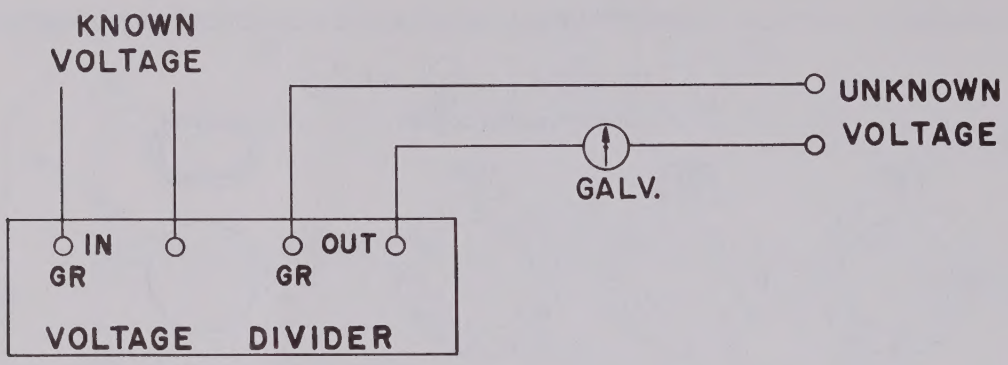

Fig. 3 - Connections for Measuring Unknown Voltage

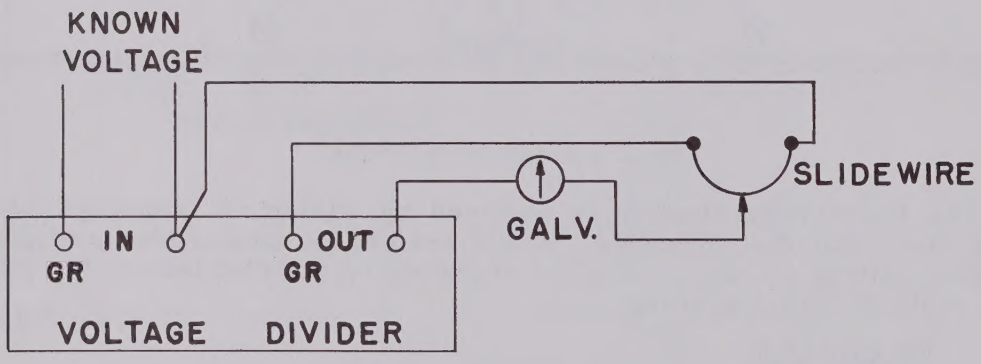

Fig. 4 - Connections for Calibrating Slidewire

$$R_T = \frac{100{,}000 \times \text{Calibration Point Value (above low end value)}}{\text{Total Slidewire Value}}$$

This method may be used for calibrating a slidewire in terms of any units if the units used bear a constant relation to the voltage.

C. To Standardize An Input Voltage

To secure any standardized d-c input voltage up to the recommended limit of 200 volts connect as shown in Fig. 3 except connect a standard cell in place of the unknown voltage. The L&N No. 7308 Standard Cell is suggested as being suitable for this purpose. Set the voltage divider in accordance with the following relation:

$$R_T = \frac{100{,}000 \times \text{Std. Cell Voltage}}{\text{Desired Input Voltage}}$$

and adjust the input voltage until a null balance is secured. Input voltage and standard cell leads of the same polarity should be connected to the GR terminals.

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